

CLAIMS

What is claimed is.

1. A capacitor comprising:

a fixed charge plate disposed in a substrate;

a movable charge plate disposed above the fixed charge plate; and

a stiffener affixed to the movable charge plate.

2. The capacitor according to claim 1, the movable charge plate further comprising:

a first separation distance between the fixed charge plate and the stiffener,

wherein the first separation distance is constant.

3. The capacitor according to claim 1, further comprising:

a first separation distance between the fixed charge plate and the stiffener,

wherein the first separation distance is constant; and

a second separation distance between the fixed charge plate and portions of the movable charge plate, wherein the second separation distance is variable.

4. The capacitor according to claim 1, wherein the fixed charge plate has a first

surface area and the movable charge plate has a second surface area that is smaller than the first

surface area.

1 5. The capacitor according to claim 1, wherein the movable charge plate comprises a
2 solid surface plate and a broken surface suspension.

1 6. The capacitor according to claim 1, wherein the movable charge plate comprises a
2 solid surface plate and a broken surface suspension, and wherein the broken surface suspension
3 has an undulating configuration.

1 7. The capacitor according to claim 1, wherein the fixed charge plate has a first
2 surface area and the movable charge plate has a second surface area that is smaller than the first
3 surface area, and wherein the movable charge plate comprises a solid surface plate and a broken
4 surface suspension.

1 8. The capacitor according to claim 1, wherein the fixed charge plate has a first
2 surface area and the movable charge plate has a second surface area that is smaller than the first
3 surface area, wherein the movable charge plate comprises a solid surface plate and a broken
4 surface suspension, and wherein the broken surface suspension has an undulating configuration.

1 9. A variable capacitor in a semiconductor device comprising:
2 a movable charge plate disposed in a semiconductor substrate;
3 means for suspending the movable charge plate;
4 means for moving the movable charge plate; and
5 a stiffener disposed upon the movable charge plate.

1 10. The variable capacitor in a semiconductor device according to claim 9, wherein
2 the means for suspending the movable charge plate comprises a flexible dielectric layer.

1 11. The variable capacitor in a semiconductor device according to claim 9, wherein
2 the means for suspending the movable charge plate comprises a flexible section of the movable
3 charge plate.

1 12. The variable capacitor in a semiconductor device according to claim 9, wherein
2 the means for moving the movable charge plate comprises a fixed actuator plate.

1 13. The variable capacitor in a semiconductor device according to claim 9, wherein
2 the means for moving the movable charge plate comprises a fixed actuator plate and a movable
3 actuator plate.

1 14. A capacitor comprising:

2 a first fixed charge plate disposed in a semiconductor substrate;

3 a flexible dielectric disposed above the first fixed charge plate;

4 a second charge plate disposed upon the flexible dielectric, wherein the flexible
5 dielectric is interposed between the first fixed charge plate and the second charge plate.

1 15. The capacitor according to claim 14, further comprising:

2 a stiffener affixed to the second charge plate.

1 16. The capacitor according to claim 14, further comprising:

2 a stiffener affixed to the second charge plate, wherein the second charge plate is
3 interposed between the stiffener and the flexible dielectric structure.

1 17. A microelectromechanical structure variable capacitor comprising:
2 a fixed charge plate disposed upon an elevated substrate;
3 a fixed actuator plate disposed upon a lower substrate, wherein the fixed actuator
4 plate is below the fixed charge plate;
5 a movable charge plate suspended above the fixed charge plate; and
6 a stiffener disposed upon the movable charge plate.

1 18. The microelectromechanical structure variable capacitor according to claim 17,
2 wherein the fixed charge plate has a first surface area and the movable charge plate has a
3 second surface area that is larger than the fixed charge plate.

1 19. The microelectromechanical structure variable capacitor according to claim 17,
2 wherein the movable charge plate comprises a solid surface plate and a broken surface
3 suspension.

1 20. The microelectromechanical structure variable capacitor according to claim 17,
2 further comprising:
3 a movable actuator plate disposed over the fixed actuator plate.

1 21. The microelectromechanical structure variable capacitor according to claim 17,
2 wherein the elevated substrate and the lower substrate have a negligible elevational
3 difference.

1 22. A method of forming a variable capacitor comprising:
2 forming a recess in a substrate;
3 forming a fixed charge plate in the recess;
4 forming a movable charge plate above the fixed charge plate;
5 forming a stiffener upon a portion of the movable charge plate.

1 23. The method of forming a variable capacitor according to claim 22, wherein
2 forming a recess in a substrate further comprises:
3 forming the fixed charge plate;
4 forming a dielectric layer upon the fixed charge plate;
5 forming a movable charge plate upon the dielectric layer; and
6 removing the dielectric layer between the fixed charge plate and the movable charge
7 plate.

1 24. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate.

1 25. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming multiple through holes in the flexible dielectric.

1 26. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming multiple through holes in the flexible dielectric, wherein the multiple
5 through holes have a relative area in a range from about 1% to about 50%.

1 27. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming at least one through hole in the flexible dielectric.

1 28. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and
4 forming at least one through hole in the flexible dielectric below the movable
5 charge plate, wherein the at least one through hole has a relative area in a range from
6 about 10% to about 40%.

1 29. The method of forming a variable capacitor according to claim 22, prior to
2 forming a movable charge plate, further comprising:
3 forming a flexible dielectric above the fixed charge plate; and

4 patterning an undulating suspension section in at least a portion of the flexible
5 dielectric.

1 30. The method of forming a variable capacitor according to claim 22 wherein prior
2 to forming a stiffener, forming a movable charge plate further comprises:

3 patterning an undulating suspension section in at least a portion of the movable
4 charge plate.

1 31. The method of forming a variable capacitor according to claim 22, wherein
2 forming a recess in the substrate further comprises:

3 forming a lower substrate;
4 forming a fixed actuator plate upon the lower substrate;
5 forming an elevated substrate; and
6 forming the fixed charge plate upon the elevated substrate.

1 32. The method of forming a variable capacitor according to claim 22, wherein
2 forming a recess in the substrate further comprises:

3 forming a lower substrate;
4 forming a fixed actuator plate upon the lower substrate;
5 forming an elevated substrate;
6 forming the fixed charge plate upon the elevated substrate; and wherein forming a
7 movable charge plate further comprises:
8 patterning the movable charge plate to form movable actuator plate.